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HOW SHOULD WE UNDERSTAND THE DIGITAL ECONOMY IN ASIA? CRITICAL ASSESSMENT AND RESEARCH AGENDA

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ABSTRACT

By *Asian digital economy*, we refer to high-tech developments, business and social transformations, and information-driven changes in the region's growth. We discuss its background and foundations, significance in Asia and contribution to removal of historical barriers in traditional business. We assess how new value chains are transforming country-level involvement in worldwide manufacturing and note "smiling curve theory" predictions about the global value chain in Asia for high-tech firms and their economies. The takeaway is that the digital economy in Asian nations involves revamping business processes through technology innovation, government policies for growth, and digital entrepreneurship. We analyze the "digital economy and society index", and attributes of nations, societies and economies, as a basis for framing our ideas. We consider research directions prompted by data analytics and AI, the platform economy, digital trade, fintech innovation, and societal and economic sustainability. We further highlight new issues in light of the COVID-19 pandemic.

Keywords: Asian digital economy, COVID-19 pandemic, digitalization, digital trade, digital transformation, economic growth, emerging technologies, firm-level technological sophistication, global value chains, industrial infrastructure, information and communication technologies (ICTs), information technology (IT), informatization, IT innovation, smiling curve, technological change, technology impacts, transaction costs, value chain participation.

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There is no one Asia. Economies are vastly different between Japan, Korea versus China, Indonesia, and India. One of the common myths is people think that developing Asia is behind in digital, and I think it's, in fact, the other way around. … The poor legacy in these developing Asian markets, whether it is IT or digital penetration, or the traditional retail and banking infrastructure, often means that digital is a great opportunity for the country to leapfrog. The most interesting digital market in Asia is actually not the likes of Korea and Japan, but is more China, Indonesia, and India. These are the markets that are really pushing the boundary and innovating the most. (Lau et al., 2016)

- A. Lau and G. Theisen, Senior Partners
C.M. Theisen, Asia Digital Comm. Head
Hong Kong / Singapore McKinsey & Co.

Southeast Asia's digital economy was worth USD 31 billion in 2015 and is forecast to grow to USD 200 billion by 2021. The kicker is that this could be a substantial underestimate if the region reaches an agreement on a common set of standards for data handling and digital commerce. (HSBC, 2020)

- HSBC Report on "The ASEAN Opportunity"

1. INTRODUCTION

The high potential of the digital economy was recognized by numerous business leaders and innovators, consultants and journalists, researchers and authors in the 1990s (e.g., Tapscott, 1996; Margherio et al., 1998). The related issues have been noted in a 2016 McKinsey Digital podcast (shown above) as well. According to Channel News Asia (Tang, 2020), the World Economic Forum and the Group of Twenty have defined the *digital economy as a* "*broad range of economic activities that use digitized information and knowledge as key factors of production, modern information networks as an important activity space, as well as information and communications technology to drive productivity growth.*" Consistent with the many documents on this topic that have been developed by the United Nations Conference on Trade and Development (2019a), we define it as representing the breadth of high technology developments, business and social transformations, and information-driven changes reflected in the growth of digital businesses, economic opportunities, and social practices around the world.

Building on this definition, then, the Asian digital economy can be viewed as encompassing the range of similar developments that we have noted for the global digital economy, but with a more limited geographic regional focusing comprising the countries of East Asia, South Asia, and Southeast Asia.[1] In spite of our limited focus, the countries in the Asian region represent the spectrum of developed and developing nations, based on the different levels of gross domestic product (GDP) per capita, and the range of Human Development Index (HDI) scores (reflecting measurements of life expectancy, literacy,

[1] We intentionally excluded the Asia Pacific region as a whole (e.g., Australia and New Zealand, and the nearby island nations), as well as those to the east of Turkey in West Asia and north of the Middle East, as well as west of China, and north and west of India (except Afghanistan) in Central Asia. Nor do we include Russia, though a large portion of its geographic mass spans the area in Asia north of China and Japan.

education, and standards of living that are observed).[2] They are far from a homogenous set of countries in all of the ways that may motivate different degrees of commitment to digitalization, as well as a different observed extent of digital economy-related economic output.[3] Although our primary interest in this article is to provide a research commentary regarding Asian digital economy activities, to do this effectively, we also discuss developments in the United States and Europe, and the global economy more generally.

1.1. Some High-Level Indicators for the Global Digital Economy's Growth

After the 2007-2008 financial crisis that began in the U.S., and later spread to Europe and Asia, the global economy entered a new stage. Traditional economic development was slowing down, while the digital economy, represented by the new generation of technologies such as mobile Internet, cloud computing, big data analytics, and artificial intelligence (AI), had sprung up (Fourcade and Kluttz, 2020). With international digitalization and informatization now entering an innovation- and information-driven era of fuller penetration due to cross-border innovation and accelerated development, the digital economy truly has become a new engine of economic growth (Curran, 2018; Gomber et al., 2018; Brynjolfsson and Collis, 2019). In recent years, the digital economy has made great progress in Asian countries, rather than just in the Western world, spurring the integration of digital technology and traditional economy activities (Ali et al., 2018; Taglioni and Winkler, 2016).

Recently, we also have seen the rise of manufacturing innovation brought about by emerging information technologies (ITs) and their applications (which include the sharing economy), blockchain technology, 3D printing, and machine learning (ML), among others around the world (Sutherland and Jarrahi, 2018). Most observers believe that the digital economy will penetrate all aspects of society, including interpersonal interactions, the economic environment, and political decision-making (Gopal et al., 2003; Hindman, 2018). It will also produce new scientific research and breakthroughs, promote employment opportunities and economic growth and improve people's way of life (Elder-Vass, 2016).

Earlier, in the 1990s, economic growth in developed nations was mainly related to the emergence of the Internet and was one of the bases for the 2010s' world-wide digital economy growth. A set of new information and communications technologies (ICTs) began to diffuse and also support the recent round of economic development and new forms of output in other countries in various regional of the world – not just developed nations (Ivanova and Sceulovs, 2018). This includes embedded sensors in new kinds of objects: new end-user devices, such as smartphones, tablets, netbooks, and 3D printers; innovative business

[2] More specifically, we are referring to: East Asia (8 countries)– Mongolia, China, Hong Kong, Macau, Taiwan, North and South Korea, and Japan; South Asia (8 countries) – Afghanistan, India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan, and the Maldives; and Southeast Asia (11 countries) – Myanmar, Thailand, Laos, Cambodia, Vietnam, Indonesia, Malaysia, Singapore, Brunei, Philippines, and Timor-Leste. The nations of Central Asia and Western Asia are not included (World Atlas, 2020).

[3] For more information related to these issues, interested readers should refer to the following sources: United Nations Development Programme (2019); World Bank Group (2019); and Yendamuri and Ingilizian (2018).

models, such as cloud computing, digital platforms, and digital services; large digital dataset dissemination, sophisticated data analytics and algorithm-based decision-making; as well as new automation and robotics technologies (OECD, 2015).[4,5]

As a result, the digital economy has been fundamentally reshaping the manufacturing industry around the world – beyond the bounds of individual countries, with IT-driven knowledge enhancement, and a more effective global industrial structure based on new technologies. This has been an influential trend that has been influencing the competitiveness of the industrial structure of various countries, strengthening the digitalization of traditional industries, while building fresh impetus for creating new service industries.

1.2. The Digital Economies of the Asian Nations

These global trends have been especially important for Asian countries and the emergence of their collective digital economy in the region, even as they have been experiencing increasing labor costs, slowdowns in trade exports, and diminished economic growth. As a result, they have experienced the need to implement supply-side reforms to achieve better performance. In this context, Asian manufacturing innovation has been long recognized as a major driver of global economic growth. With the rise of manufacturing industries in Asian countries in the past 40 years, China, South Korea, Taiwan, Japan in East Asia, and some of South Asian and Southeast Asian nations have become "production factories" for the world (e.g., clothing and textiles, machine tools and auto parts, electronics and computer components), and an important part of the "global value chain" (Frederick, 2017a, 2017b).

The World Economic Forum (2015) and Boston Consulting Group (United Nations Conference on Trade and Development, 2015) reported in 2015 that the global digital economy was growing at a double-digit rate – and especially so in Asia. UNCTAD also reported that global business-to-business (B2B) sales exceeded USD 15 trillion in 2013, with about three-quarters of sales occurring in the following four countries: China, Japan, U.S and U.K. Business-to-customer (B2C) sales in the same year were estimated at USD 1.2 trillion, while Asia and Oceania were the most prominent regions with their global shares of B2C sales estimated to have risen from 28% in 2013 to 37% by 2018. The root cause of this kind of regional growth clearly technological innovation, but this was supplemented by the strong economic interests and policy promotion efforts of the Asian nations' governments (Curran, 2018).

For Asian countries at this stage, it is then of practical significance to promote the digital transformation of their manufacturing industries. By creating their own "spring tide" for digitalization, they have been

[4] Various institutions have produced reports on the digital economy. For example, an announcement of an initiative issued by the G20 Summit defined the digital economy as a series of economic activities that use digital knowledge and information as key production factors, modern information networks as important carriers, and use of ICTs as important driving forces for efficiency improvement and economic structure optimization (Leaders of the G20 Summit, 2016; Zhang and Chen, 2019).

[5] Bukht and Heeks (2017) include embedded sensors and the Internet of Things (IoT), new end-user devices (mobile phones), digital storage / processing models (cloud and digital platforms), and big data.

making strides toward more fully realizing the transformation of their economies and societies. The results have been notable in terms of their economic performance and the new high-tech initiatives that they have undertaken. In 2018, for example, China's digital economy reached RMB 31.3 trillion (USD 4.4 trillion), according to a white paper on its economic development by the Cyberspace Administration of China (2019), accounting for 34.8% of GDP. A national-level strategic initiative there is the "Made in China 2025 Campaign" (Institute for Security and Development Policy, 2018).

Earlier in the 2010s, other Asian nations found paths for innovation to foster additional economic impetus and expand their digital economies. A leading example is the "Make in India Campaign," which was begun in 2014 after India's new Prime Minister, Narendra Modi, was elected to office (MakeInIndia.com, 2020). Around that time, the economic slowdown of the BRICS countries (Brazil, Russia, India, China, and South Africa) had become widely recognized in government policy-making circles and the global business press. Others include: the "New Robot Strategy" in Japan (Headquarters for Japan's Revitalization, 2015; Japan Robot Association, 2015); the "Thailand 4.0 / Digital Thailand" national business and government transformation initiative (Digital Government Development Agency, 2017; Bukht and Heeks, 2018); and the "AI Information Industry Development Strategy" in South Korea (Shin, 2019; Paypay.me, 2019). Finally, embedding aspects of digital economy functionality into traditional manufacturing has been recognized as essential for the manufacturing sectors of the Asian nations.

1.3. Research Questions

If an Asian nation wants to use the development of a digital economy to improve its position in the global value chain, strengthen its economic growth, and prevent a possible recession, its industry and government policy-makers must have a solid understanding of how the digital economy works. Several issues need to be considered and several research questions (RQ) must be asked:

(1) What is the nature of the future digital economy that is intended to transform an Asian country's industry setting? And, what measures will be applicable to gauge its economic performance as time passes?

(2) How does the digital economy support development of Asian countries' manufacturing industries? What upgrade paths are realistic, how should the relevant technologies be leveraged to achieve the best performance with them, and what role does a country's industrial policy play in the developmental process overall?

(3) Are there governance and value-added distribution structures (i.e., how the different stages, from R&D to Marketing, contribute to the overall value, see Section 2.3) from the global value chains of various industries that need to be put into place in Asian countries? What opportunities and challenges do these changes create for them?

The overall contribution that we make is to lay out, explain and interpret the shifts that have been

occurring in the realization of the digital economy in many Asian nations. The key takeaway of this article is that the developments are due to the countries' need to revamp their traditional business processes, promote extensive technology innovation, support government policies for economic growth, and build high capacity for digital entrepreneurship. We turn to the further consideration of these issues in subsequent sections of this article. We also discuss the role that the COVID-19 pandemic seems to be playing in Asian digital economy settings in 2020 and how this may affect future digital development.

2. TRANSACTION BARRIERS, THE GLOBAL SUPPLY CHAIN AND MANUFACTURING

How has the growth of digital economy functionality affected the barriers to transaction-making in digital commerce? And how has it been influencing Asian nations' participation in the global supply chains and more advanced and digitalized manufacturing? In the past, the Asian countries, especially China, mostly acted as suppliers to the Western industrial and consumers markets. The emphasis was on one-way global supply chain vendors, such as the Hong Kong-based Li & Fung, Ltd., which created rapid construction of supply chain network capabilities that were unrivaled in southern China for nearly a decade (Li et al., 2007). Today, however, China has become more of a global player on par with the U.S. in terms of not just market size but also increasingly in terms of digital innovations in international trade and within its own domestic industries. While Chinese manufacturers used to be considered as copycats, they are now developing successful business models that are truly innovative with no real matches in the West (e.g., Ant Financial and WeChat), as well as multi-way global supply networks. Moreover, supply chain coordinators like Li & Fung, Ltd. (2018) have begun to re-envision their business domain as one which requires transaction turnaround speed, new business models and innovations, and seamless, end-to-end platform digitalization for supply chain effectiveness. The same things increasingly apply to other Asian nations, especially South Korea, Japan, and India.

2.1. Diminishing Transaction Barriers and Reducing Marketplace Friction

The traditional economies of countries around the world – in the U.S., Europe and Asia – with their high transaction costs, are frictional. The term "friction" in this context refers to factors that make a market less than a perfectly competitive market. In theory, economic activities are associated with the presence of specific real costs that must be paid, but the existence of excessive friction has led to an increase in a range of costs that everyone still experiences. The result also has been to hinder new competitors from entering the market, restrict consumer choices of the types of goods they wish to purchase, and affect market efficiency and consumer welfare. These frictional factors also can result from transport costs incurred by the buyer and seller due to distance, and costs incurred by buyers and sellers due to information asymmetries. Such frictions can be understood as being related to the existence of market transaction costs. With the help of network tools, the digital economy has reduced transaction costs to a great extent, expanded

economic activities to a global scale, and supported an economic era with fewer frictions (Chang, 2019).

Digital commerce processes have promoted the transition from traditional economy activities across three stages: pre-transaction, in-transaction and post-transaction activities (Gopal et al., 2003). The transaction costs of each stage have been affected by different factors in developed countries (Kehal and Singh, 2005). First, for their market transactions, consumers need to obtain information about the manufacturer on the items or commodities they wish to purchase. Whether they are advised by relatives, friends, or social media, consumers must pay the cost of the pre-transaction search. In the digital economy, pre-transaction search costs have been sharply reduced. Instead of going out themselves, consumers can find suitable manufacturers, stores, and goods on the Internet through the search engines they use in their homes. In addition, intelligent agent software helps consumers to search for products and compare their prices, so that they can buy cheaper and higher-quality goods. Moreover, there are many online platforms which provide product and commodity information, reducing the information cost of online buyers in searching for desired items. This has become more and more observed in Asian countries now too.

Second, in the trading process, sellers may take advantage of rich information that describes consumers and their purchasing preferences, while consumers can only bargain with sellers on the prices they post. This inevitably results in bargaining costs. In the digital economy, the cost of consumers' price comparisons through the Internet is competitive, which makes it difficult for businesses to discriminate against them, and thus reduces the bargaining costs in online shopping. Consumers only need to click on the goods they wish to buy, fill in their personal information, and complete the ordering process.

Third, the completion of transactions also requires delivery and after-sales service, which leads to post-transaction costs. In the digital economy, computer software, e-books, digital newspapers, movies, MP3 music and other content products are all digital commodities now. Their most prominent feature is that they can be transmitted directly through a network. As a result, consumers can avoid transaction costs from delivery charges through extensive digitalization, a feature in global commerce overall now.

Although the traditional economy has been changing, this does not mean that transaction costs in economic activities have completely disappeared though. A frictionless economy is an ideal state, much like perfect competition in economic theory. In fact, with advances in ICTs, though there has been a reduction in traditional transaction costs, there still are other roadblocks, such as the protection costs for intellectual property rights and network congestion costs, and cultural and other regulatory issues that have become much more prominent due to their differences across countries in different regions.

2.2. The Global Value Chain, Digital Inputs and Value Chain Participation

The study of global value chains originated in Sociology. The concept of a "global value chain" is not the same as the value chain in typical business activities, which focuses on how a company can best structure its business strategy by shifting its focus with respect to the allocation of business activities

(Gereffi et al., 2005). Global value chain studies consider how companies strive to optimize production networks to influence the generation and transfer of value within the supply chain network (Frederick, 2017a, 2017b), and how value distribution structure affects the mechanism for enterprises to organize their international production networks (Tan et al., 2017). The framework for global value chain analysis emphasizes the value-added process, from concept and design to production to distribution, final use and returns within an industry (Harms et al., 2012). It integrates global industries around the world from both the top-down and bottom-up perspectives based on job content, technology, standards, rules, products, processes and markets in specific industries and locations (Taglioni and Winkler, 2016).

For a long time, technological progress has injected vitality into the development of global value chains and provided less-developed countries and regions with access to global value chains and ways to achieve economic development (Rodrik, 2018). Differences in geographic locations, labor forces and technology levels, and the enterprise types present in different countries all affect their market power and profitability in the global value chain. The technological sophistication of firms in different countries plays an important role in decision-making that results in the extent of their outsourcing.

Harms et al. (2012) found that labor cost is the primary factor that pushes multinational corporations around the world toward deciding whether to engage in offshore production and establish targets for outsourcing. Their level of technological sophistication also determines whether outsourcing services providers can undertake the outsourcing business of multinational corporations, which in turn may allow such enterprises can participate in the global value chain. Although in recent years China's rising labor costs in the textile and apparel manufacturing industries have led multinational companies to withdraw their outsourcing business from China and transfer it to Southeast Asia and other countries (Frederick, 2017a, 2017b), some sectors with higher technology content cannot be transferred in a short time. This is because there is not enough technical capability in some Southeast Asian countries to undertake the changes with expectations of success. It can be concluded that technological progress affects the positioning along a global value chain.

New ICTs in the digital economy era have had a profound impact on the existing global production division system (Baldwin, 2016). Tan et al. (2017) indicated that technological change and other factors have promoted global value chain reconstruction based on the core features of global production organization and global industry specialization. Technology-driven value chain restructuring plays a positive role in promoting changes in a country's international competitiveness. So, Asian countries need to take advantage of opportunities related to tech changes to enhance participation in global value chains.

Digitalization also affects the competitiveness and position of enterprises in the global value chain. In the global division of production, unit labor costs have become a major factor in determining the competitive pattern of the industry (Sandeep and Ravishankar, 2018). The reduction of unit labor costs is

benefiting from the process of informatization and digitalization. Gereffi et al. (2005) defined three ways of upgrading global value chains to achieve this: through product upgrades, function upgrades, and inter-industry upgrades. Any kind of upgrading cannot be achieved without labor, capital and better productivity. Among them, process upgrading by increasing total factor productivity means that one cannot be directly attributed to the upgrading of labor and capital factors, such as using the latest IT to improve production efficiency. Informatization and the extent of digital input involved also will impact the position of the global value chain for a department, enterprise or country, and a firm's ability to acquire value in the global division of production.

The digital economy consists of two related parts. "Digital industrialization" is its core, and "industrial digitalization" is its extension (Kehal and Singh, 2005). In comparison to the more readily understood former term, the latter is focused on improving the efficiency and output of traditional manufacturing and service industries. This has the potential to change an industry's competitiveness in the world and its position in the global value chain. At present, the development of the digital economy in various sectors of a nation's overall economy typically shows distinct differences relative to others.

The proportion of the digital economy value created in the overall value-added of larger national industrial activities can be understood in comparative terms based on the performance characteristics of the dominant service industry, the second-ranked industry and the lowest-ranked industry (typically agriculture). According to a "Research Report on the Digital Economy of the G20 Countries" (China Trust Investment Corporation, 2017), Germany's service industry had the highest proportion of the nation's digital economy at 55.9%, while the service industries in Great Britain and the U.S. were lower at 53.6% and 53.3%, respectively. In Asia, the top-ranked country on this metric in recent years was China, which ranked sixth at ~29%. In industrial activities, the G20 countries tend to host the highest proportion of production of digital economy value. Germany is the world leader in the development of industrial digitalization, with its digital industrial economy accounting for 41.8% of industry value-added, with South Korea nest at 41.3%, and then Japan and China, with digitalization levels of 29.6% and 18.0%.

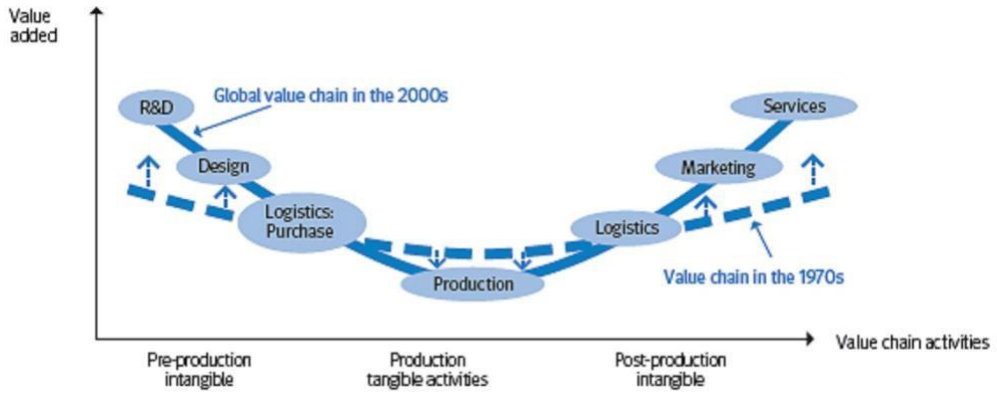
Today, as a result, the manufacturing industries in the various Asian nations have become the focus of business transformation and technology infrastructure upgrades. This is due to the relative position in the countries' national economies. This is also affected by the strengthening trend of integrating the Internet into the manufacturing industry. After the financial crisis in the 2000s, the manufacturing industry in Asia was in an apropos position for reshaping its development, with adjustments made to its unbalanced structure and the re-creation of its competitive advantage. The combination of intelligent machines, modern communications, big data and cloud computing in the era of the digital economy is causing other beneficial changes in manufacturing production. Different labels, such as intelligent manufacturing, Industry 4.0 and the industrial Internet are synonyms for the transformation that is underway.

2.3. Digital Economy: Reshaping Global Value Chains in Manufacturing

The distribution of value-added in global value chains also has been undergoing some changes that have not occurred in the past (Hindman, 2018). The changes require new perspectives and models to understand the nature of the production activities and competition patterns that can be observed. The changes also highlight the opportunities and challenges that Asian countries face when seeking to upgrade their international industrial status. Specifically, the distribution of value-added in the global value chain is changing. This is the distribution of value creation among the participants in different stages and geographical locations, as well as for different size global value chains. Activities in the value chain potentially create value for a firm that manufactures and sells goods, but their relative importance may be affected by their value appropriation capabilities in the competitive market. The typical analysis is founded on three general stages of firm-level actions that have been widely discussed in the literature on firm strategy: pre-production, production, and post-production processes.

Production activities in manufacturing lead to (mostly) physical and tangible output (though quality may be considered as intangible). One can think of what is done as yielding outputs in a factory production line (e.g., one manufacturing automobiles or mobile phones) or in a craftwork setting (e.g., customized architectural drawings), with individuals who do the work. *Pre-production activities* include R&D, design and materials acquisition for production, and are mostly intangible. No additional "products" are produced, but, instead, pre-production activities make the production of a firm's products possible. After manufacturing, *post-production activities*, e.g. distribution, marketing and services activities, occur. These also do not yield anything that adds to the physical output of a firm. However, intangible activities involving faster delivery and less expensive logistics, better marketing and attractive product packaging, more competitive pricing, and enhanced after-sales services often are what enables a firm to get appropriate value in the market.

Figure 1. Gauging Value-Added in the Three Stages of Firm-Level Actions with the Smiling Curve



Source: OECD (2013)

A well-known theory in this field is the so-called "smiling curve" depicted in Figure 1, where the three stages mentioned earlier can be identified. The theory tells us that high value-added lies at both ends of the curve, representing the downstream and upstream ends of the value chain, while the processing and assembly activities are in the middle of the curve, which is the lowest value-added region (Shin et al., 2012). The figure suggests that value-added at the extreme ends of the curve – created via intangible pre-production and intangible post-production activities – has been increasing in recent decades.[6] This curve has become the basis for one of the most important theories in global value chain research (Baldwin, 2016).

Gereffi and Fernandez-Stark (2016) have pointed out that the main challenge of economic upgrades in the global value chain is to define the conditions under which developing and developed countries and their enterprises can "climb the value chain." This involves upgrading from basic assembly activities based on cheap and unskilled labor and moving to more advanced, all-in-one supply and integrated manufacturing. However, high-value activities focus more on pre- and post-production manufacturing services, which poses a challenge for Asian countries to implement appropriate labor development strategies to provide these services locally.[7]

Companies that control brand and production concepts in global value chains (e.g., Apple) and leading products that provide core technologies and advanced components (e.g., iPhone) often are more profitable. At the same time, contract manufacturers and business process outsourcing suppliers often make only smaller profits (Elder-Vass, 2016). And, traditionally, they have only rarely or never gained the ability to develop their own branded products.

[6] The interested reader should see OECD (2013) for additional background. Further note the additional curvature of the relationship that are depicted when the 1970s versus the 2000s are considered.

[7] From the global value chain perspective, the smiling curve describes the ability to lead enterprises so that they outsource the lower value-added activities. In other words, multinational corporations must define their core competitiveness, concentrate on innovation, product strategy, marketing, and higher value-added links for manufacturing and services, and reduce the general services and the mass production activities of their non-core business (Pisano, 2015).

Cattaneo et al. (2010) have argued that the current distribution structure of global value chains has become more stable, with large multinational manufacturers, retailers and distributors controlling the global procurement networks, but still claiming that they need fewer, larger and more capable suppliers. In contrast, the current distribution of value-added in global value chains, as suggested by the theory, may exhibit two kinds of evolution through new technological changes in the digital economy era. They will bring new opportunities and challenges to decision-makers. The opportunities are for emerging economies to become drivers of global production and value winners through digitalization, while the challenges are the issues that developed economies will face to maintain their past leadership.

Embedding digital technology will result in two possible changes in the value-distribution structure of the global value chain. The first is "complementary integration," which is aimed at linking the production factors of the digital economy with the non-productive activities present in the global division of labor. This will supplement traditional non-productive value-added activities with advanced technology for informatization and digitalization. This may include combining the Internet with sales, developing new products by adding materials manufacturing (e.g., via 3D printing), and marketing via social media. So, the invisible production links which originally yielded high profits will be able to obtain higher profits because of the adoption of advanced production technology or the improvement in efficiency or cost savings (Elder-Vass, 2016). The shape of the smiling curve will be affected, and the value-added gap between the tangible and intangible production links will be widened. This should result in two negative effects impacting the firms that have been at work in the production and assembly links. First, the gains will become more compressed, which is not conducive to the expansion of production and the growth of trade. Second, the difficulty of climbing to the high end of the global value chain will be increased, and the disadvantageous position will be further solidified.

Another possible change in the structure of value-added distribution occurs when the substitution of production factors in digital economy firms is integrated into the production chain. This second one is called "alternative integration." New factors of production will directly enter the original tangible production processes and assembly links, replacing large-scale pipeline operations, and possibly replacing intensive and cheap labor. This will occur, for example, when 3D printing of products is initiated. The production links which originally drove lower income will yield more income for distribution because of their higher-technology implementation, encouraging improvements in efficiency and new cost-savings. The smiling curve will become shallower in its curvature, and the gap between tangible production and intangible production will be diminished. In addition, the links of the original global value chain will also change at the same time. In the process of implementing alternative integration, for example, the logistics links also may be completely replaced due to spatial changes. Our central argument is that these kinds of changes are what have been driven the historic shift to the digital economy in Asia, and pushing many nations in the

process far beyond the business processes of the traditional economy.

2.4. The Impact of COVID-19

The COVID19 pandemic started in late 2019 and has been having a profound impact on the everyday lives of people around the world, and especially so in Asia, where the virus originally emerged. What needs to be assessed is the extent of the impacts: How long will they last? Which digital businesses will be affected and how? And will the overall global economy and the economies of individual economies be impacted to different degrees and at different points in time?

As of June 2020, the duration of the COVID-19 pandemic was expected to last be as much as 18 to 24 months, which means it was potentially projected to last well into 2022 (Moore et al., 2020). This is a long period by itself, but it also is relevant to consider that some of the pandemic's effects are likely to last longer and probably create definitive changes at various levels of the economies that feel its effects.

The impact on the global economy has been a generalized downturn in economic activity, and tourism, hospitality and transport services. All major countries are suffering an overall contraction of their GDP in 2020, with China as the only exception, yet for which a 2.6% GDP growth is still expected (Fernandes, 2020). More recent forecasts from the National Bureau of Statistics of China are even more optimistic, since a growth of 3.2% is envisaged in Q2 of 2020 with respect to the same period of the previous year (National Bureau of Statistics of China, 2020). That level of positive growth is actually a reduction of the much larger expansion that was expected before the pandemic took place. For China, a 42% reduction of offline consumption has been foreseen for 2020 (year-on-year from 2019), with a smaller but still substantial 20% reduction of online consumption (Chen et al., 2020). The contraction differential hides a substitution effect, with online shopping replacing brick-and-mortar selling and achieving an increased share of 33% more activity. A similar increase of 26.8% compared to 2019 has been observed in India (Bhalekar, 2020).

Despite the evidence of recession that have already been observed, the pandemic also has accelerated structural changes that were on the way, in particular, by pushing companies toward online services (e.g., digital banking in Singapore and Southeast Asia (Lu, 2020). The vehicle for such services is Internet traffic, which has increased everywhere, for example, doubling in Italy, achieving a 31% increase in Japan (Bergman and Inìyengar, 2020; Okuda and Karazhanova, 2020). Major increases also have been recorded in news and digital publishing, video streaming, gaming, social media, and education. Even among the youngest consumers (Generation X, Generation Z, and millennials), a proportion between 10% and 12% of first-time online shoppers has been recorded (Kim, 2020).

The increased prominence of online business is not limited to consumption, since increased demand calls for investments in a variety of areas. Tashanova et al. (2020) highlighted investment opportunities in online services such as entertainment, education, medical services, and food, for example. An additional

consequence of increased demand is a likely surge in prices, since consumers are exhibiting a six-fold increase in their reservation prices for online services compared to 2016 (Wang and Jamison, 2020).

An indirect effect of the shift to online services will be the impact on transportation (Hendrickson and Rilett, 2020): the surge in demand for online shopping is already spurring an increase in transportation demand for goods delivery (McLeod, 2020). There also is expected to be higher demand for social distancing in airline transport, causing ticket prices to climb higher as airplane load factors are less likely to return to their pre-COVID-19 levels (Abdullah, 2020). Aside from incremental effects (though their size can be so large as to be disruptive), we also should mention the development of new technologies as a positive spillover of the pandemic. Okyere et al. (2020) noted development of autonomous vehicles for delivery, use of robots in hospitals and unsafe areas, and educational technologies.

3. RESEARCH OPPORTUNITIES

As the digital economy has developed around the world, it has brought changes to the traditional economies and global value chains in Asia. As a result, there are many new research opportunities that researchers can take tap into in the region. In this section, we illustrate the most recent advances and most promising topics, by grouping them under subsections. Two of them concern the tools and resources that can be leveraged for the digital economy (big data / AI and platform economics). Three describe application domains (fintech, digital trade, and sustainability and human welfare). The last wo concerns the market structure emerging from the digital economy landscape, and the effects of the COVID-19 pandemic.

3.1. Big Data and Artificial Intelligence

If digitalization of data was the main thrust for the birth of the digital economy, two major pushes for its development have come from the ever-widening availability of massive amounts of big data and the capability of extracting useful information from them through the latest techniques of AI and computational social science analytics.

Since the global financial crisis, the opportunities for dividends from past technology implementation have been largely exhausted. As a result, the Asian countries have needed a new impetus for economic growth. Data analytics and AI have been predicted to give economists, business leaders and entrepreneurs new hope for such an impetus—a prognostication that has mostly proven to be true (Brynjolfsson and Kahin, 2002). In addition, big data-focused applications have penetrated nearly every industry and business function, and have gradually become an important factor of production, as was predicted many years ago to happen. The use of data-at-scale also has begun to support a new wave of productivity growth, which is creating new consumer surplus. With the increasing diversity of user needs and the implementation of new technologies, big data has been accelerating the penetration of AI applications in business and society. This

has been increasingly true in Asian countries and has been supporting new demand for job creation, especially related to data science (Business Times / Reuters, 2018).

Some of the issues in the Asian digital economy context that are worthwhile for further study from the social science perspective involve the application of AI in business and social contexts (Zhang and Chen, 2019). We report some major examples. The capabilities of AI, natural language processing and chatbots for customer-facing services are being explored in the banking, finance and insurance settings, such as in Singapore and Southeast Asia (Chitturu et al., 2017; Singapore Business Review, 2017; Fintechnews Singapore, 2019a). Also ongoing are business research and data analytics process developments activities related to AI in credit scoring (Shimazu, 2019), crime data analytics-based detection of payment fraud for anti-money laundering risk management (Carrick et al., 2019; Harding, 2019), and other high-tech policies to ensure such processes are engineered for strength and cybersecurity (Nandikotkur, 2019). In addition, it is worthwhile to target the study of the uses of big data analytics for onboarding (Grover, 2019) and tracking customer behavior (Chang et al., 2014) and help Asian banks and their business customers move toward first-degree price discrimination segment-of-one marketing (maximum price consumer will pay for an item). The goal to enhance sellers' profitability is to get them to go beyond third-degree price discrimination (pricing by segmentation on consumer attributes) and second-degree price segmentation (pricing by quantity demanded). Human behavior can also be tracked for public health protection in epidemics or large-scale disasters (Ganasegeran and Abdulrahman, 2020).

3.2. The Platform Economy

The platform economy is an increasingly global ecosystem-based on digital technology, which is composed of data-driven, open platform-supported and network-coordinated economic activities (Ghosh, 2006).[8] Platforms involve frequent interactions among various parties, as well as intense competition among participating enterprises and many business process, service and technology innovations (Codagnone et al., 2018; Zhao et al., 2019). Platforms on the Internet aggregate many buyers, sellers and other e-commerce service providers, to form a vibrant business ecosystem (Ivanova and Sceulovs, 2018).

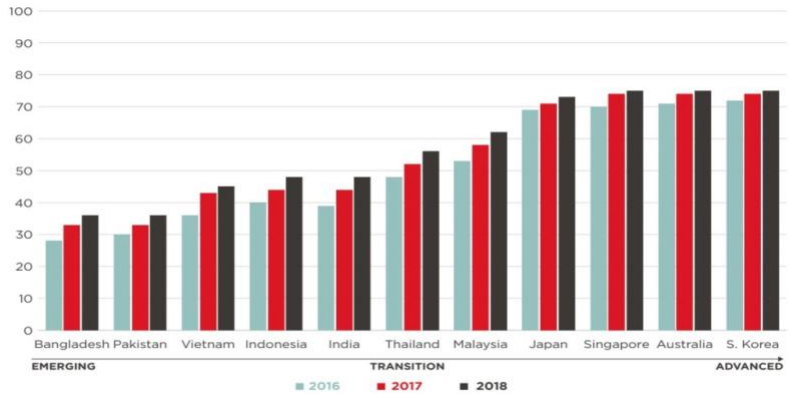
The platform economy needs new organizational forms that meet its development requirements though. Based on the principle of network synergy (Hernandez and Shaver, 2018), a new type of organization that cuts across companies and markets – the digital platform – will become the foundation of the future business economy (Torrance and Staeritz, 2019). This will cause the work environments of a majority of people to undergo drastic changes. Moreover, in China, the platform economy is recognized as a future direction for e-commerce development and technology research (Yang et al., 2017).[9]

[8] This is often referred to as "Digital Economy 2.0." in China (Zhang and Chen, 2019).

[9] Yang et al. (2017) focused on telecom and logistics in China. They noted: "[I]*ntellectualization has become a new trend for* [*the*]

An important potential area for research is related to mobile collaborative platforms and the digital readiness of countries, as discussed by a white paper from the GSM Association (GSMA) (Stryjak and Ulrich, 2019). It reports on the results of a survey that its outreach platform, GSM Intelligence, has done annually from 2015 to 2018 for the eleven Asia-Pacific countries. They include Australia, Bangladesh, India, Indonesia, Japan, Malaysia, Pakistan, Singapore, South Korea, Thailand and Vietnam. Figure 2 provides at-a-glance information on the countries that are members of the GSM Association GSMA), and their digital economy and society index scores (DESI), focusing on the 2018 DESIs.[10] By way of comparison, China's index in 2018 was 48 (European Commission, 2020).

Figure 2. (DESI) and Platform Readiness: Asia 2016-2018



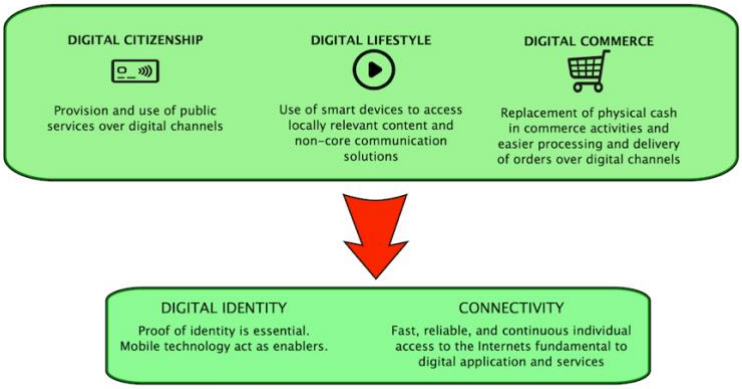
Source: GSMA Intelligence (2019) with data from European Commission in 2018**.**

Stryjak and Ulrich (2019) suggested issue areas that are natural targets for further investigation. The European Commission (2019) referred to these as: connectivity, human capital, use of Internet services, integration of digital technology, and digital public services. GSMA offers a similar set of areas with slightly different reference terms: connectivity, digital identity, digital citizenship, and digital commerce. We next will discuss some of research opportunities arising from each of the issue areas related to the key components of the DESIs. (See Figure 3 for an overview and definitions of terms.)

telecom industry, driven by intelligent technology including cloud computing, big data, and [*the*] *Internet of* [*T*]*hings. … to satisfy the service demand* [*for*] *intelligent logistics,* [*the authors*] *designed an intelligent logistics platform containing the main applications such as e-commerce, self-service transceiver, big data analysis, path location and distribution optimization.*"

[10] This list notably excludes China, the Philippines, and Taiwan, which all have had mobile phone operator / members in GSMA over the year, but apparently were not able to be tracked in terms of the survey's metrics.

Figure 3. GSM Association's Key Components of a Digital Society



Source: GSMA Intelligence (2019). Source: Adapted from European Commission materials.

Connectivity. Mobile phones have become the dominant mode of access for individual connectivity, as embodied in the DESI measures related to the Internet. A primary area of investigation concerns the limits to collaboration affecting any existing under-served citizen groups, as well as the more general digital divide issues. The "connectivity" sub-index scores ran between 43 and 81 in 2018, so there was wide variation among the countries surveyed. Such variations in connectivity are also linked with variations in the technologies involved and their stage of deployment. While some countries have already started commercial 5G services, 4G is still used to reach other countries, though likely to be ubiquitous throughout Asia by 2022 (GSM Association, 2019).

A notable example of an advanced stage of deployment is South Korea, where the launch of 5G commercial services already took place in April 2019. A 6G national project is expected to start in 2021 (Kim et al., 2020). Trials are ongoing for other innovative services, in particular for autonomous driving, smart factories, 5G media, public safety, and smart cities (Okumura et al. 2019). In addition, China has a leading global role in 5G technologies, with some innovative applications in smart cities and connected cars (Woyke, 2018), as well as medicine (Li and Wang, 2019). Other experimental trials have been reported for Japan (Okimura et al., 2019), where the application areas are considered to be entertainment, smart cities (for crime prevention and security services), and medicine (for remote healthcare diagnosis).

Digital identity. "Digital identity" refers to the extent to which people have interoperable digital national identities, and access to anonymous, self-sovereign digital identity platforms like blockchain and its variants (Toth and Anderson-Priddy, 2020). For example, as of March 2020, Australia was just beginning to launch its "MyGovID" digital identity system. Meanwhile, similar developments and existing systems in other countries (e.g., India and Pakistan) permit the digital tracking of birth registrations, with India's Aadhar digital, biometric identity registration system a notable instance (Economist, 2018). Moreover, only Singapore among the Asia-Pacific nations has implemented a pan-national ID system, the Singapore Personal Identity (SingPass, singpass.gov.sg), back in 2003.

Digital citizenship. Another component is "digital citizenship," which is measured by the richness, pervasiveness and availability of e-government services. Digital citizenship creates a basis for citizen participation in a range of government activities, as well as easier access to key aspects of social services, enhancing citizen well-being. South Korea is some distance ahead of other countries thanks to its 1996 commitment to making publicly-collected, non-personal data available open for citizen use, as well as emphasizing the transparency of the data collection and information sharing process (Lee et al., 2012). This has created the potential for studies of citizen taxation, election voting patterns and accessibility, and the country's efforts with encouraging businesses and home-owners to adopt more sustainable and green energy and water use practices. So digital economy issues related to all of these aspects of digital citizenship are now more open to being studied than in the past.

Digital lifestyle. The "digital lifestyle" country performance indicator is primarily based on measurement of the extent of access that the population has to smart devices, considering IoT diffusion and the availability of local digital content. Mobile payment services offered by mobile phone services operators create a basis for revenue generation in the telecom sector of Asian countries, as well as the further penetration of mobile operators into key industry verticals. Similar to the other component sub-index scores, the measurement of digital lifestyle patterns offers unique opportunities for researchers to obtain relatively direct access to data for interesting quasi-experimental research designs, as well as new insights into sectoral and social developments that reflect digital lifestyle changes (Kauffman et al., 2017). By connecting the index scores and other aspects of mobile collaboration platform availability, it will be possible for researchers and policy analysts to design interesting computational social science (CSS) experiments that will be able to yield causal insights from rigorous and unobtrusive research designs – a key theme that this journal has emphasized in recent years.

Digital commerce. Among all of the "digital commerce" country index scores, the one with the lowest base as of 2018 is related to the extent to which quite a few nations lacked critical infrastructure to make financial inclusion widespread and effective as a means for promoting e-commerce on digital platforms. Five countries had DESI scores on digital commerce that were less than 30 (Bangladesh, Pakistan, Vietnam, Indonesia, and India), while other countries had scores on this component of between 50-60, when aspects of digital commerce development and financial inclusion are considered.

Some issues that are worthwhile to research are related to platform collaborations that can support cross-border payments and family remittance services. An example is the success of Tranglo Pte. Ltd. (Singapore) to partner with fintech payment provider Alipay of China (Fintechnews Singapore, 2019b). Another technology application area involves the marriage of messaging apps with platform services capabilities. This capability can support digital purchasing via mobile money services that benefit from richer and less expensive simultaneous digital messaging support, so consumers can gain more intimate

knowledge of the products and services they wish to consumer. Another app direction is being explored by a 2019 Global Mobile Awards winner, KT Corp. (Korea Telecom). Its innovation is to combine AI-based and voice-certified mobile services that make fintech mobile payment more intelligent and suited for inclusion in digital platforms (MarketWatch, 2019). These developments open up new avenues for research innovations with new technologies, new services and new business and social settings.

3.3. Digital Trade

In contrast to prior trade and supply chain activities, however, there is a new emphasis on "digital trade." This refers to a business model that relies on the Internet and uses digitally-enabled transactions as a means for buyers and sellers to exchange physical or digital goods and services and deliver them in physical or digital form (OECD, 2020). It has a broader scope than e-commerce, though the two terms are often viewed by many as synonyms.[11] China has been increasingly recognized as the global leader in digital trade, with its national economy benefiting from an estimated productivity-led gain of up to RMB 37 trillion (USD 5.5 trillion) by 2030 (Yang, 2019). There also is broad agreement that digital trade will be the dominant mode for international and domestic exchange in the coming years, as digital economy transaction models spread around the world (Akhtar and Morrison, 2017).

A form of digital trade is cross-border e-commerce, which has been discussed in the European Union context (Sinkovics et al., 2007). Compared with traditional trade, digital trade shortens the space-time distance, reduces transaction costs, and improves transactional and exchange efficiency (Gomez-Herrera et al., 2014). In addition, digital trade has optimized the traditional trade system, simplified the trade process, and increased trade opportunities (OECD, 2019).

Digital trade in Asian countries has developed rapidly. But fast development of the associated business practices also has left urgent problems for research, including the scope and definition of digital trade, the formulation of trade standards, data standards for such trade transactions, the development of digital trade platform technology, and the appropriateness of government regulation (Duch-Brown et al. 2017; Monteiro and Teh, 2017; Meltzer and Lovelock, 2018). Researchers interested in the Asian digital economy have ample opportunities to apply knowledge from earlier and ongoing European cross-border digital economy and trade experience, scientific research and the effects of regulation.

3.4. Fintech

Under the theme of fintech innovations, there are several research topics that are especially relevant for Asia. We consider three major areas: achieving transparency of transactions (which can be enabled by the blockchain mechanism), creating and safely using digital currencies, and introducing smart contracts.

[11] See the survey of definitions available at https://www.globalaccesspartners.org/HSF-Digital-trade-definition.pdf.

In the digital economy, people's trading activities have moved from offline to online, and from the physical world to the digital world. However, without the high-technology innovations associated with payments, trading and exchange, activities in the digital world may be subject to fraud and damage to transaction value (Gomber et al., 2018). The creditworthiness of digital trade and exchange participants also is often difficult to establish, and such activities are easily disrupted when fraud and hacking occur.

The consulting firm, Booz Allen Hamilton, published a research report in 2018, stating that "*Asia as a geography experienced 668 cyber-attacks over the six-month research period, making it the primary geographical target for cyber-crime*" (SWIFT, 2019b). Recommendations have also been made regarding the avoidance of institutional payment fraud in a recent e-book that emphasizes basic defenses, countermeasures and best practices for financial institutions (SWIFT 2019a). The study of such topics is especially worthwhile in support of Asian digital economy operations, where trading relationships need to be based on more open and transparent transaction information, including counter-party payment risks. This is likely to benefit all the stakeholders involved – buyers, suppliers, payment intermediaries, and trading platforms, among others – so that transaction costs are reduced.

Blockchain technology, smart contracts and encrypted currencies play a role in search for concurrent transparency and security, to bring salient and beneficial effects in supporting the digitalization of trade-and-exchange relationships and support international trade (Ganne, 2018). The central idea behind blockchain is to replace traditional counter-party relationships related to payments in the market with distributed transaction-making, adopting a decentralized approach based on the distributed validation and archiving. The role of blockchain in support of fintech platforms and digital economy network operations is not limited and goes beyond those domains (Dhar and Stein, 2017; Hurlihy, 2019).

Four blockchain hubs have been identified in Asia, based on the presence of tech firms with R&D commitments to blockchain projects, the national digital and regulatory framework, the popularity of their markets for funding and capital raising by going beyond initial coin offerings (ICOs), and the demand for such technology (Lim et al., 2019). China, Japan, Singapore, and South Korea are all involved. A leading role in research, for example, is played by China, judging by the number of researchers, scientific papers, and patents from recent years (Wang et al., 2020). However, blockchain innovations have a significant role in the development of smaller economies as well. Its use to reduce inefficiencies related to moving goods across countries is a boost for Southeast Asia, by improving trade logistics, streamlining trade finance and customs clearance, and enhancing supply chain traceability (Suominen, 2018).

There are many other examples of blockchain adoption in different contexts in Asia. In the supply chain, blockchain allows every event or transaction to be recorded on a distributed ledger in a secure and unchangeable way. This is particularly useful for product recall or origin identification of components and raw materials that have found to be defective. Kshetri and Loukoianova (2019) described some of the

projects taking place throughout Asia. A notable application to the supply chain in the agri-food industry is reported by Tian (2016), which blends the use of radio frequency identification with blockchain technology for food commodities' origin identification.

Process automation and cost reduction in financial institutions also are benefiting from blockchain, as illustrated by the results of a South Korean survey (Oh and Shong, 2017). Equity crowdfunding also is becoming easier with blockchain, by using low-cost registration of stocks and shares, simple transfers of crowdfunding equities, peer-to-peer (P2P) transactions by investors and entrepreneurs, the involvement of funders through voting, as well as support for regulatory activities (Zhu and Zhou, 2016). Other applications in China have been described for the public sector and e-government (Hou, 2017).

Digital currencies are a building block in the shift to a digital economy. The Bank for International Settlements (BIS) (2015) has suggested that digital currencies can serve in different roles related to money and exchange mechanisms. First, they act as assets whose value is determined by supply and demand, similar to commodities like gold. Second, they offer a P2P exchange mechanism for the transfer of value based on the operations of distributed ledgers, which track and validate a digital currency's value and provide a complete historical, digitally-encrypted transaction record typically in blockchain form (e.g., via Bitcoin, Litecoin or Ethereum, or other digital currencies) (Wang et al. 2019c). These roles and additional background related to physical and digital money are summarized below. (See Figure 4.)

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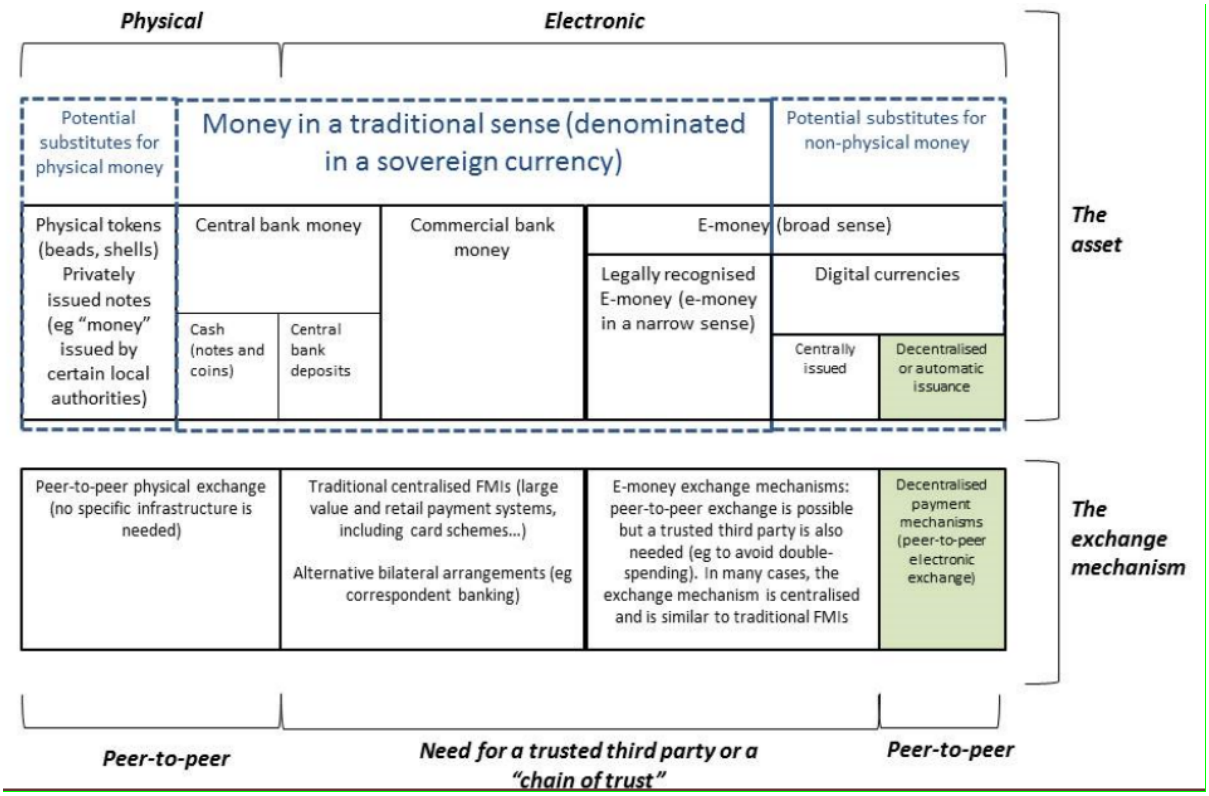
Figure 4. Bank for International Settlements' Taxonomy of Money and Exchange Mechanisms



Source: Bank for International Settlements (2015)

The security of digital currencies is often guaranteed through cryptographic techniques, so they are typically referred to as "cryptocurrencies" (Li et al., 2019). Their diffusion across borders in East Asia is subject to the different treatment by national laws in various countries (Low and Wu, 2019). However, the diffusion of digital currencies has been peculiar in Asia, since China has exerted strong regulatory control (Hess, 2017), and China and Singapore have sought to devise central bank-controlled digital currencies (Khiaonarong and Humphrey, 2019).

Several lines of research have emerged to understand and deal with risks associated with large-scale usage of such currencies (Arner et al., 2019). Of particular interest is the potential for applying smart contract approaches in this part of the world. Several examples suggest new research. Two recent surveys on the applications of smart contracts by Chinese researchers deserve discussion. Wang et al. (2019b) identified three areas of interest: contract vulnerabilities, limitations of the blockchain technology for building smart contracts, and privacy and legal issues. Zheng et al. (2020) took a lifecycle-oriented view, and highlighted the potential for studies on the creation, deployment, execution, and completion of smart contracts. Other authors have paid particular attention to vulnerability issues, with research focused on repeated payments related to the same contract – the "reentrancy attack" problem (Liu et al., 2018).

The applications of interest span several fields. Gartner, a U.S.-based consultancy, for example,has

been studying the potential for blockchain and smart contract applications (Roy, 2020). An area that deserves attention is the creation of smart contracts for certifying property related to physical objects (e.g., real estate) and intangible assets (e.g., intellectual property) (de La Rosa et al., 2016; Spielman, 2016; Bodó et al., 2018).

In finance more broadly, there are many application contexts, such as for transaction management related to China's poverty alleviation loan scheme (Wang et al., 2019a). Such research will support the efforts Asian countries have been making to further understand the most appropriate uses of blockchain technologies and successfully adopt digital currencies and smart contract approaches (Matthews, 2019). In healthcare, blockchain approaches can be used to keep patient records and for controlling access privileges for data analytics (Bhuiyan et al., 2018). Efforts also are being made in different Asian nations to create more digitally-enabled municipal and federal government organizations, and these are open for researchers to explore the issues (Ghandour et al., 2019; Xie et al., 2019). Legal issues can be investigated as well, especially as to the validity of smart contracts (Lee, 2019), the adequacy of the current legal framework to deal with them, and the regulation of their use (Wang and Chen, 2018, 2019). This suggests that law and information researchers, as well as legal research firms' involvement will be beneficial.[12]

3.5. Sustainability: Digital Economy for Human Welfare

Integration of the digital economy with the real-world economy has the potential to enhance people's lives, based on the work of the United Nations (UNCTAD, 2019a, 2019b). The contributions of the digital economy to improve the welfare of people is an intended outcome that is consistent with the United Nations' 2030 Agenda for Sustainable Development (United Nations, 2015). (See Figure 5 for the full set of 17 goals.)

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[12] Singapore Management University and the National Research Foundation (2019) announced a S$15 million Research Programme in Computational Law that is intended to *"study and develop open source technologies for 'smart' contracts and 'smart' statutes, starting with the design and implementation of a domainspecific programming language (DSL) that allows for laws, rules and agreements to be expressed in code. This paves the way for 'smart' contracts and statutes that can be reliably executed by computers to enable precise and accurate performance and compliance. The eventual industry adoption of the DSL will facilitate the delivery of more efficient legal and regulatory services through digital systems, and will broaden access to justice."* Other countries in Asia, including from Japan on legal information, topic analysis and complex network analytics (Ashihara et al., 2020), China on automated judgment and legal reading comprehension (Long et al., 2019), and Hong Kong on the use of computation social science methods in conceptual and empirical legal research (Whalen, 2020). These efforts in various Asian countries are pursuing related avenues of technological innovation with the goal of bringing legal studies and scholarly work into the current era of computer science innovations – which is likely to grow and flourish in years to come.

Figure 5. United Nations' Sustainable Development Goals

Source: United Nations (2020, https://sustainabledevelopment.un.org/?menu=1300)

Smith and Seyfang (2013) and Hargreaves et al. (2013), in research on grassroots innovations for sustainability, offer insights on energy technologies and the digital economy. Such tech innovations apply to countries where policy-makers and scientific researchers are thinking about how to marry sustainable energy, water, air and land issues with solar tech for the sustainability of electric power. The former authors noted that:

> *"Studying different community ownership initiatives for supplying electricity from daylight using rooftop solar photovoltaics (PV), Hess (2013) analyses how the associated power relations disadvantage frustrates grassroots framings of urban energy. The innovation and diffusion of solar electricity involves different socio-technical designs whose various forms of organization, ownership, and economic model compete. Grassroots configurations are contrasted with corporate configurations. Interestingly, the firms promoting a corporate roll out of PV comes from outside [the] incumbent electricity business. The former includes information and communications technology (ICT) firms, whose access to finance and political decision-making is decisive not only for out-competing grassroots approaches, but also for providing a countervailing power to the incumbent electricity business. Interestingly, this is no straightforward three-way competition. Rather, important interdependencies are revealed in the ways grassroots experiments provide appropriable components (e.g., organizational models) for commercial socio-technical configurations, and how such appropriations motivate grassroots reactions for more inclusive community responses"* (Smith and Seyfang, 2013, p. 828).

Hess (2013) further underlined the importance of encouraging Asian e-commerce and digital economy researchers to investigate sustainable energy issues by using additional interdisciplinary framing. Every economy around the world faces challenges related to electricity production, pricing and sustainability. They also must consider alternative modes of technology investments to create additional power production capacity, the approach of energy intermediaries to the market, and how to make the best commitment to current and next-generation technologies. The demand for sustainable housing, considering architecture,

engineering, human factors, and environment to cope with varied climate conditions in different countries and regions is increasingly interesting to digital economy firms (Kubota et al., 2018). Companies such as Apple, Amazon and Google have been developing open-source smart home standards, to ensure that any supported smart home device will work, regardless of the control device (smartphone or voice assistant) of choice (Kastranekes, 2019). Their technology solutions put a high premium on citizen informedness about energy consumption and hazardous materials recycling opportunities at the household level (Lim-Wavde and Kauffman, 2018; Lim-Wavde et al., 2017). Related research also has considered the issue of citizen informedness about climate change. It deals with the paradox of informedness and the related difficulty of distinguishing real from fake news in this domain, as well as a government's efforts to help citizens debunk fake news (Lim-Wavde and Kauffman, 2019).

In addition to energy production and consumption, and how these issues can be addressed by improving citizen informedness about their actions, another issue in Asian digital economies is the transformation of transportation, fueled by the growth of ride-sharing apps on mobile phones. Several articles in Electronic Commerce Research and Applications and other research outlets have touched on multiple issues with the sharing culture and fair access in a world of demand-and-supply dynamics that vary with competition, weather, congestion, and driver ride-service provider incentives (Kauffman and Naldi, 2020). In addition, Clemons et al. (2017) have considered many of the changes and transformations that can be observed as being a by-product of information-driven changes in strategy and society. The authors argued that they have been made possible by digital platforms, mobile phones, social media and other technological advances.

We suggest that many similar issues and additional current concerns can be identified that are worthwhile to investigate in depth related to the Asian digital economy, with sustainability and social transformation in mind. Ornetzeder and Rohracher (2013), for example, have reported on the rise of wind generation in Denmark, do-it-yourself solar energy collection in Germany, and car-sharing in Switzerland – all based on the perspective of grassroots innovations that are affected by the local socio-technical regime. Others have examined IT and e-commerce issues relate to products and services. For example, Raghezian and Weber (2019) modeled how the sharing economy culture and its various practices have affected product pricing decisions for things such as automobiles and lawnmowers. Xu and Schrier (2019), in contrast, focused more on human factors and the aesthetics of hospitality sharing economy platforms and services, to understand how privacy risk affects consumer search and booking behavior. Building on existing knowledge about hospitality in the sharing economy, Dann et al. (2020) conducted an online experiment to assess the social and economic value of booking lodgings where the unknown host is "part of the deal." They learned that user value expectations are driven by both the hosts' representation of what is being offered, as well as the personal information of the consumer, who must express her purchase preferences.

In the ride-sharing context, Basili and Rossi (2020) conducted multiple case studies of booking

platform providers across several service domains. They studied how the choices consumers made to gauge the quality of their services and reputation systems affect the incentives, effort and performance of drivers to comply with the firms' service quality standards. They found that "reputation portability" matters. So, the digital intermediaries need to take care of how they manage their own online reputations. Again, related to the quality of services as perceived by consumers in the bike-riding market, Shao et al. (2020) examined the influence of factors on customer booking intention and their willingness-to-book. In particular, they examined bicycle location reliability, the intermediary's promptness of responses to consumers' standard and customized requests, service transaction assurance, and ad vividness.

Zuo et al. (2019) used text-mining methods and big data analytics to understand the customer service issues associated with the ride-sharing services of Didi Chuxing in China, suggesting the high frontier of research opportunity for the use of computational social science methods in digital commerce and sharing platform operations. Another ride-sharing study from China explored the issue of the lack of people who are willing to become ride-sharing drivers (Cheng et al., 2020). They applied uncertainty reduction theory to illustrate the power of problems with drivers' trust-in-passengers, based on a variety of dimensions: driving expenses, social interactions, driver enjoyment, cancellation of ride-sharing orders, on-time payment, politeness and appearance, online reviews and ratings. A final ride-sharing study from China focused on Didi Chuxing's entry into 51 Chinese cities (Guo et al., 2018). The authors observed that Didi's competitors' drivers bought more new cars on average to boost their ride-hailing service revenues following Didi's entry. But the "new car" effects seemed to have abated over time: ride-sharing platform operations apparent do not dramatically influence automobile firm revenues over the long run.

3.6. Innovation and Monopoly in the Digital Economy

Innovation is more critical than ever in the digital economy era. Innovation should concern not just technology but organizations, management methods, and business models as well. Innovations in Internet platforms and services and the IT world have become keys to the future development of the digital economy. If Asian countries want to catch up with other countries in the digital economy era, they need to promote improvements in their infrastructures and business models actively. Helpful interventions may include government support for new technology ecosystems, easing financing and fund-raising activities, and speeding up licensing and regulatory actions (e.g., see the case of submarine cables reported by He (2010)). Other interventions include embracing the new collaboration modes of the digital economy, creating an innovative environment, and integrating big data and AI for better business operations.

Aside from these country-specific issues, the digital economy has brought about some global issues that need to be addressed also. For instance, technological barriers and the evolving control of consumer data have resulted in new monopoly power and more dominant positions for digital platform firms, resulting in increasingly apparent firm power problems in the digital economy (Hindman, 2018). A potential

conundrum arises since innovation is often spurred by the massive use of such data: and data restriction policies may result in the unfortunate inhibition of valuable innovation (Ferracane and van der Marel, 2020). However, the largest firms may use their dominant market positions to obtain higher profits in anti-competitive ways though, such as via discriminatory pricing and targeted sales based on deep knowledge of consumer preferences. They may also leverage limited production and price increases, along with highly selective reductions in their quality of products.[13] Actually, some of the giant tech firms that are the main digital platform players (Apple, Amazon, Google and Facebook) (Galloway, 2017) have been charged with anti-competitive conduct and fostering problems for consumers in the market (Ho, 2019; Lunden, 2020). So, there is a strong impetus for research to study the shifting nature of competition in the digital economy-focused markets in the Asian region.[14]

3.7. What May Change with COVID-19

Earlier, we wrote that COVID-19 has been accelerating the adoption of digital and online tools. This has certainly been a boost for the digital economies of many of the Asian nations, and this effect is likely to last well after the pandemic has ended. However, will this also result in changes to the focal research topics that we have discussed? Or will there just be more of what we already have been seeing? We think that there will be some new research threads that may be associated with the growing role of online activities. In particular, we foresee new developments in the following areas that will become more prominent in the Asian digital economies: logistics (including new technologies for delivery), and trust.

As we mentioned earlier, the surge in online shopping (in particular for fresh products) has put a strain on delivery everywhere in the world, especially where there are constraints on eating out at restaurants and gaining access to supermarkets for safe food shopping. Though this can be thought of as requiring optimization of logistics, the type and amount of new constraints may require quite a bit of effort. Online customers, as a result, are likely to organize their demand to form a new mass-market, with delivery expectations that cannot be bent too much to meet the suppliers' operations based on the optimization procedures they implement. For example, the sustainability of that mass-market, after the COVID-19 lockdowns are eased and people return to their normal "outside life" will require that delivery is accomplished at times and days compatible with their customers' working life. This could cause peaks in delivery requests, for example, early in the morning or late in the afternoon, which have to be managed effectively. This may disrupt the smoother, spaced-out over-time optimized scheduling approaches that

[13] We have referred to this as a "damaged services strategy," in which a firm decides to segment customers its marketplace based on their willingness-to-pay by offering a version of a product or service that has full capabilities, as opposed to another that is intentionally weakened in some way with reduced functionality, as with reduced functionality password vault software, or on-demand, surge-priced access to cloud computing rather than reserved services (Huang et al., 2015; Shang et al., 2020).

[14] For example, the interested reader should article on sharing economy issues involving Airbnb and Uber by Kauffman and Naldi (2020), as well as other valuable articles on sharing economy market structure and firm regulation by Edelman and Geradin (2015) and Codagnone et al. (2018).

merchants are likely to view as profit-maximizing.

This is an enormous market for many countries in Asia. For example, Statista (2020) estimated China's 2020 online food delivery services market segment as approximately USD 51.5 billion – growing to USD 67.6 billion by 2024 – with the platform-to-consumer food delivery segment there slated to reach about USD 37.7 billion in 2020. COVID-19 has pushed those revenue numbers higher. On a broader basis, an issue related to the problem of home delivery logistics for food and other products is the need for the development of new technologies that will help to improve and streamline the delivery process. In a more futuristic perspective, the development of autonomous vehicles, drones, and robots are likely to be of greater interest in terms of their use for e-commerce support (Hu, 2020).

Finally, we have one of the biggest hindrances to the widespread adoption of e-commerce in the digital economy: trust. So far, trust has been required so consumers and merchants believe in the security of payment systems, so that quality of markets for the online sale of goods and the suppliers' and sellers' and sellers' reputations are viewed as reliable. The latter issue involves both the capability of the merchant to deliver in the first place, as well as the conformity of products to their description and to an adequate``` quality standard. The appearance of COVID-19 has added a new dimension of trust, which is likely to remain in the future: the capability of the supplier to guarantee the proper handling of the products it sells – especially food – in particular as to sanitary measures and protection against health hazards. This will probably have consequences for the development of loyalty, since the amount of trust (in its different nuanced forms), that will be required of customers will drive them toward the establishment of stronger, longer-lasting ties with reputable online providers, and, in turn, drive them away from unreliable, non-compliant merchants.

By the same token, we expect to see a new ensemble of corporate and government work-from-home (WFH), as many organizations learn about the benefits of distance work and what's required to keep their employees safe when healthcare concerns are paramount in society. There seems to be a new and vigorous reassessment toward the digitalization and virtualization of social exchanges involving all sorts of person-to-person interactions. They include consultations by phone and screen with healthcare professionals and tax consultants, university faculty and business meetings carried out via Microsoft Teams and Skype, and the continuity of essential government services when society is locked down.

We also have seen a vigorous innovation with COVID-19-related fundraising. One example is the April 18, 2020 "OneWorld: Together at Home Concert," which public figures, actors, writers and musicians in which the participants gave short messages and music performances from their homes (Beaumont-Thomas, 2020). Another is April 27, 2020 "Take Me to the World: A Sondheim 90th Birthday Zoom Celebration," in honor of the legendary American composer and lyricist, Stephen Sondheim. The Zoom broadcast involved famous singers, actors and musicians performing songs from composer's Broadway musicals –

from their "bedrooms, bathrooms, sties, and kitchens" (Brantley, 2020).[15]

These examples and settings suggest that there is a new kind of "creative destruction" (Economist, 2020) at work in this time of COVID-19 that will bear careful investigation in the coming years around the world – including the counties of East, Southeast and South Asia. The COVID-19 pandemic, if it has had any positive effects in the wake of its economic fallout and healthcare tragedy, they are related to the acceleration of business, social, technological and healthcare innovation for transformation that increase the flexibility of people and our institutions to deal with the "unknown unknowns" of living in truly uncertain times.

4. FINAL THOUGHTS

The key takeaway from this research is that the developments we have chronicled related to the global digital economy clearly point to the Asian countries' need to revamp their traditional business processes to support better growth, enhance the availability of technological innovation to power the transformation, build government policies that are supportive of new models of social interaction to enhance domestic economic growth, and continue to encourage the high capacity for digital entrepreneurship and successful start-ups.

One of the topics that we have not discussed in any depth is the extent to which digital economy technologies can support useful information service platforms for citizens (Zhao et al., 2015; Ali et al., 2018). Many governments – whether municipal, county or federal – are willingly making their data available to citizens and researchers. The availability of data under the "open data" paradigm (Janssen et al., 2012) allows universities and research organizations to perform numerous kinds of analysis, whose results may then guide the policy-making and administrative decision-making on key issues.

Though we touched on digital identification services and government agency access to relevant data and information that citizens may be able to obtain, as noted by the United Nations Sustainable Development Goals, poverty is a long-standing issue of grave interest to most countries in Asia, as well as across the developing world. Among the various industry models of the digital economy, e-commerce has developed in ways that enable people to gain fairer and more equal access to information and government services, to overcome the prior digital divide between "Internet haves and have nots," and to provide a backbone architecture to aid in the alleviation of poverty in areas that need help the most. The digital economy has made it so that no place is remote or inaccessible anymore. Further, most people have access to information in ways that history never permitted, when information circulated in paper form (e.g., books,

[15] OneWorld brought in USD 127 million in charitable donations for the World Health Organization (WHO) and other charities in the process. The Sondheim birthday celebration was a fundraiser for Artists Striving to End Poverty (ASTEP), which received USD 400,000 in donations.

newspapers, journals, and government surveys, etc.), and was much more tightly controlled.

In addition, the emergence of microcredit services on P2P lending platforms, and the innovative new fintech start-ups that are working to transform financial infrastructures, insurance and remittance services for better access and fair pricing to serve heretofore unbanked poor people at the bottom-of-the-pyramid (Deloitte, 2017) offer hopeful signs of technological and social progress. The long-standing maxim of the deceased Harvard University author, C.K. Prahalad (2009), has never been truer than it is now. There is indeed "fortune at the bottom of the pyramid," and "poverty can be eradicated through profits" arising from the new economics of the global digital economy. This has special relevance for the nations in Asia, large and small, developed and developing alike.

Summing up, the answer to the first half of RQ1 is that what is changing more the big picture in which businesses operate in Asian countries is that the digital economy makes access to information and financing means much easier. As to the second half of RQ1, aside from the traditional measures of economic activity, the Digital Economy and Society Index (DESI) is emerging as a specific indicator of the spread of the digital economy (and a proxy for its economic performance).

As to RQ2 and RQ3, major changes in technological processes have changed the value-added distribution in the global value chain and may allow Asian countries to get a bigger share in the global value chain. The still large divide between Western countries and Asian countries in the contribution of the digital economy to the overall value-added pie can be reduced by a strong push towards the digital economy in those countries (especially from South-East Asia), in particular by integrating more the Internet into the manufacturing industry. Upgrade paths may involve complementary integration, linking digital economy with the non-productive activities within the global value chain, and alternative integration, with new factors of production entering the tangible production process.

Another aspect of the digital economies of Asian countries is the extent to which they bring the nature of these countries' governments' citizen surveillance efforts into clear focus. For example, in Singapore there has been discussion of the government's roll out a COVID-19 contact tracing app, that works via a wearable mobile phone dongle, and interfaces with a dedicated server (Toh, 2020). The emergence of elements of a "surveillance economy" is interesting, because it plays out so differently in the different countries around the world. In the U.S., for example, it is mostly private sector-driven, with companies like Facebook and Google knowing more about its citizens than the U.S. government does. In contrast, the Chinese government seems to be the primary catalyst for tracking people. For example, tracing infection chains through mobile apps has been considered to be crucial for beating COVID-19, and Internet users saw video news of the use of drones to remind citizens on the street in Wuhan to be careful to wear a mask in public to avoid infection (CNN, 2020). In this context, it is clear that there is an important debate that needs to be conducted. One immediate issue is whether centralized or decentralized software designs will

be more effective in the time of coronavirus to help prevent contagion effects. But a more vexing set of social issues arises around what the trade-offs are with respect to different degrees of software-based tracking surveillance may be. The Brookings Institution (Litan and Lowy, 2020) recently released a report that discusses freedom versus privacy in the larger context of unmonitored healthcare risks versus app-traced healthcare security. There are additional that are worthwhile to explore further. [16]

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[16] For an alternate view of these issues, a recent article (Paton Walsh, 2020) on COVID-19 pandemic testing and individual freedoms in the U.S. points out that, in this era of mass data collection (e.g., via our mobile phone GPS and whom we talk to, where we travel and buy things (and eat lunch or dinner), and digital traces of our DNA, fingerprints, photos, email, and sentiments, etc. makes it so that the citizens of many countries have entered a new "era of privacy lost."

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